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Review Article

Psychiatry/Mental Health Section

Unravelling the Enigma of Highly Superior Autobiographical Memory: Signs, Symptoms and Treatment Perspectives: A Narrative Review

ROHIT WANI[1], BHAGYESH SAPKALE[2], SUPRIYA MESHRAM[3], SACHIN R GEDAM[4]

ABSTRACT

Highly Superior Autobiographical Memory (HSAM) is an extremely rare phenomenon characterised by an exceptional ability to recall personal life events vividly. The present review article explores the unique characteristics of HSAM that distinguish it from other memory phenomena, such as mnemonics. Currently listed on the global diagnosis list up to 2024, with only 62 documented cases, HSAM presents a fascinating cognitive and neurological complexity, including increased functional connectivity within some brain regions, particularly the left temporoparietal junction. Typically, individuals with HSAM exhibit very vivid recollections of both significant and mundane events, which they cannot control or intentionally suppress. The article also reviews some possible psychological and biological substrates of HSAM; among these, semantic processing and atypical neurodevelopment are of particular importance. The overlap between HSAM and conditions such as autism is also discussed, as they might share features such as compulsive fixations on dates and an inability to "get over" bad memories. While the mechanism by which certain treatments become effective for HSAM is poorly understood, the use of interventions such as deep brain stimulation or cognitive-behavioural therapy may be warranted. This review calls for more research, hoping to stimulate interest in therapeutic interventions designed for patients with HSAM, ultimately leading to a greater understanding of this intriguing cognitive phenomenon.

Keywords: Cognitive neuroscience, Hyperthymesia, Memory disorders, Memory recall, Neuropsychology, Synesthesia

INTRODUCTION

Hyperthymesia, sometimes referred to as HSAM, is a disorder that causes an excessively high number of life events to be vividly remembered by the individual [1]. As of 2024, only 62 people worldwide had received a diagnosis for this incredibly rare condition [2]. A person with HSAM is referred to as a hyperthymesiac [3]. According to American neurobiologists Elizabeth Parker, Larry Cahill and James McGaugh (2006), the two hallmarks of HSAM include an extraordinary ability to remember specific past experiences and an excessive amount of time spent thinking about the past [4].

The term hyperthymesia comes from the Greek words 'hyper,' meaning extreme, and 'thymesis,' which refers to recalling. This term may also relate to the Greek word 'enthymesis,' derived from 'thymos' (meaning mind), which implies 'consideration' [2,5]. Individuals with HSAM have the capacity to recollect, quite accurately, details of everyday situations that occurred decades ago [3,6]. It is easy to differentiate HSAM from other types of extraordinary memory, such as that of mnemonists [4,7].

Using mnemonic devices or engaging in overt, thorough content memorisation are two methods for creating strong memories [7]. Unlike many memory specialists, individuals with HSAM indicate that they do not intentionally practice their experiences or use mnemonic strategies to develop strong memories [5,8]. Enhanced abilities in areas such as verbal fluency, attention/inhibition, executive functioning, mnemonic discrimination, perception, visual working memory, and the processing and retention of emotional information may play a significant role in HSAM [3,9].

Search Methodology

Using a methodological approach, the present narrative review examines HSAM. Relevant keywords such as hyperthymesia, memory recall, autobiographical memory, neuropsychology, cognitive neuroscience, memory disorders and synesthesia are utilised in a detailed search strategy across databases like PubMed and Scopus. Peer-reviewed English publications are prioritised in the inclusion criteria, and thorough screening by impartial reviewers ensures that the articles are relevant. To address the symptoms, diagnosis and treatment of HSAM, systematic data extraction, quality assessment, and result synthesis are conducted. The report highlights research gaps, provides a critical evaluation of current work, and suggests future lines of inquiry.

The present research was aimed to provide a clear, understandable and useful narrative review of HSAM for potential focused treatments, considering reference management and ethical issues. HSAM is defined as the capacity to reliably recollect a remarkable quantity of experiences and the dates corresponding to those experiences from events that occurred over a significant portion of an individual's lifetime [4]. Greater cognitive ability is unlikely to be the cause of HSAM [9,10]. Individuals with HSAM show better functional connections with sensory cortices and increased activity in the left temporoparietal junction compared to individuals without HSAM [10,11].

Epidemiology of HSAM

Highly superior autobiographical memory is a very rare phenomenon that, as of 2024, has been identified in only 62 people worldwide [2]. Due to HSAM's relative obscurity, it is impossible to firmly state its frequency, let alone its demographic distribution. Epidemiological data specifically regarding HSAM is unavailable, making it difficult to draw conclusions about gender, age, ethnic, or geographical variability [3]. As a result, HSAM is a relatively rare condition that is most likely underinvestigated and underidentified due to the paucity of published cases. More research is needed to determine whether HSAM is associated with particular genes, environmental factors, or cultural influences [1,2].

Complexities of Involuntary Recollections in HSAM

People with history, as well as, are able to recollect a great deal of their personal history as well as public events that are meaningful to them. Those affected characterise their recollections as uncontrollably linked associations; without hesitation or conscious effort, they 'see' a clear picture of a specific date in their minds [12]. Although individuals describe their recollections as vivid, they are not accurate records of everything that happened. There is a distinction between people with HSAM and those with other types of extraordinary memory, as the former typically do not learn lengthy sequences of material using mnemonic devices or similar rehearsing techniques [1,8].

Individuals with HSAM usually recall intimate, autobiographical memories of both significant and mundane life experiences [2,13]. This vast and extremely uncommon memory is encoded involuntarily and retrieved spontaneously; it is not the result of mnemonic techniques [7]. Hyperthymestics are not calendrical calculators, unlike many individuals with savant syndrome, even though they may be capable of remembering the day of the week on which a particular date fell [14]. Instead, hyperthymestic recall is thought to be a subconscious process and is typically limited to an individual's life events [11,14].

HSAM and its Overlapping Traits with Autism

While individuals with a high degree of HSAM are not considered to be autistic, there are some parallels between the two disorders [6,15]. Some people with HSAM may also have an unusual and compulsive interest in dates, much like autistic savants [14,15]. Individuals who are hyperthymestic seem to have a poorer recall than usual for random information [5]. HSAM and time-space synesthesia are closely related [3]. Those with HSAM also struggle to let go of painful memories or challenging experiences, which can linger with them for the rest of their lives [16]. Many people have been compelled to reconsider what constitutes a 'healthy' memory due to cases of HSAM: 'it is not just about retaining the significant stuff'. The ability to move on from the past is far more crucial [17]. Parallels between HSAM and autism are featured in [Table/Fig-1] [3,5,6,15-17].

Feature	HSAM	Autism
Autism diagnosis [6,15]	Not considered autistic	Spectrum disorder
Interest in dates [6,15]	Obsessive interest	Common in savants
Random information recall [5]	Worse than usual	Varies
Relationship to time-space synesthesia [3]	Closely related	Not directly linked
Memory of painful experiences [16]	Vivid and enduring	Can be intense and persistent
Challenge of letting go [16,17]	Difficulty forgetting	Varied, but struggles exist
Redefining 'healthy' memory [17]	Raises questions	Emphasis on selective recall

[Table/Fig-1]: Parrallels of HSAM and autism [3,5,6,15-17].

Autism diagnosis: Individuals with HSAM do not have autism, while the latter is regarded as a spectrum.

Interest in dates: HSAM is characterised by a preoccupation with dates, similar to the interest displayed by autistic savants.

Random information recall: Recall of random facts is impaired in HSAM, whereas it is more fluctuating in autism.

Time-space synesthesia: This phenomenon is concurrently related to HSAM and is not associated with autism.

Memory of painful experiences: Individuals with HSAM retain memories as if they happened yesterday; these could be highly charged recalled experiences depending on the level of autism.

Challenge of letting go: Forgetfulness is a major issue that comes with HSAM, and there are similar difficulties in autism, as well.

'Healthy' memory: It is interesting for HSAM to question what counts as a healthy memory; for autism, it is, after all, selective recall.

Exploring Mechanisms Behind HSAM and Extraordinary Memory Capacity

Psychological insights of HSAM: Due to the small percentage of cases of HSAM, not much is understood about the mechanisms underlying this exceptional memory capacity [17,18]. It has been suggested that semantic processing is involved in the original event encoding for these individuals, and as a result, retrieval involves the use of semantic cues. After being cued, the memory is recovered episodically and exhibits behaviour akin to a spreading activation model [12,19]. During recall, individuals with HSAM experience both semantic and episodic memory [20]. Personality traits that are more common in hyperthymics than in the general population include a propensity to imagine and absorb new information [21]. Psychological insights regarding HSAM are mentioned in [Table/Fig-2] [12,19-21].

Aspect	Key points
Memory encoding and retrieval [12,19]	Semantic processing involved, semantic cues used for retrieval, spreading activation model during recall
Recall experience [20]	Both 'knowing' and 'remembering' experienced
Personality traits [21]	Prone to imagination and information intake

[Table/Fig-2]: Psychological insights of HSAM [12,19-21].

Biological Foundations of HSAM

Very few patients with HSAM have been reported to have enlargements in the caudate nucleus and the temporal lobe [11]. The executive function deficiencies observed in HSAM may be caused by a malfunctioning frontostriatal circuit [11,22]. Alzheimer's disease and Obsessive-compulsive Disorder (OCD) are two neurodevelopmental illnesses in which the frontostriatal circuit is vital [23,24]. Possible causes of hyperthymestic ability include abnormal neurodevelopment [16]. In terms of autobiographical memory, declarative memory-meaning memory for facts and events-is encoded by the hippocampus, which is located in the medial temporal lobe, and stored by the temporal cortex [25]. The caudate nucleus is inherently linked to OCD because it is primarily associated with procedural memory, specifically habit-building [26].

Stronger connections between the hippocampus and prefrontal cortex, as well as, increased activity in the temporoparietal junction and medial prefrontal areas of the brain in individuals with HSAM, indicate that these regions may be involved in facilitating the condition [27,28]. Some researchers believe that there is no practical limit to the number of long-term memories the brain can retain, given the vast number of possible synaptic connections [4,28]. Memories can often be vividly recalled, particularly when the temporal lobes are specifically stimulated [28]. An individual with HSAM can piece together memories using traces and add associations and post-event data [27]. The biological foundations of HSAM are described in [Table/Fig-3] [4,11,16,23-28].

Area	Findings	Potential implications
Temporal lobe and caudate nucleus [11]	Enlargements in some HSAM cases	May contribute to memory capacity or executive function
Frontostriatal circuit [23,24]	Potential malfunction linked to executive function deficiencies	Shared circuit with Alzheimer's and OCD
Possible causes [16]	Abnormal neurodevelopment	Underlies both memory and OCD aspects
Autobiographical memory encoding and storage [25]	Hippocampus and medial temporal lobe for encoding, temporal cortex for storage	Key brain regions for long-term memories
Caudate nucleus and OCD [26]	Procedural memory and habit formation	Explains potential OCD link in HSAM
Prefrontal cortex and hippocampus [27,28]	Increased connections in HSAM individuals	May be involved in facilitating HSAM

Synaptic connections and memory limit [4,28]	Potentially limitless memory storage due to vast synaptic connections	Theoretical explanation for HSAM capacity
Temporal lobe and vivid memory recall [28]	Stimulation triggers vivid recall, memory piecing together with traces and associations	Explains detailed and long-lasting HSAM memories

[Table/Fig-3]: Biological foundations of HSAM [4,11,16,23-28].

Area: This relates to the procedures of a specific part of the brain or a pathway in relation to memory or another function.

Findings: This outlines general observations or pathologies of these brain areas, primarily in individuals with HSAM.

Potential implications: This discusses how these results may provide insights into memory processing, the executive system, other associated disorders, or offer clues regarding HSAM and its neural substrates.

Diagnostic Criteria and Diagnostic Modalities for HSAM

There are currently no specific diagnostic criteria for HSAM that have been recognised clinically across global platforms. Current tests conducted to diagnose HSAM include memory testing. Generally, tests are administered based on the individual's ability to remember significant dates, occasions, and experiences, with the aim of comparing their recollections to standards such as news articles or personal calendars [12,15]. Individuals with HSAM display outstanding memory performance in recalling and remembering large amounts of supposedly trivial but distinctive information for extended periods [16].

Another approach known as structured interviews is also used for diagnosing HSAM. These interviews are mainly restricted to particular time frames or periods within a person's life to evaluate the richness and precision of autobiographical recall [3,9]. In this context, it is noteworthy that the strength of HSAM compared to other types of memory lies in its ability to remember even seemingly insignificant details, and to do so accurately [9].

Other investigational tools include functional Magnetic Resonance Imaging (fMRI) and Positron Emission Tomography (PET) [12]. These scans may help researchers identify structural and/or functional changes in the memory networks of individuals with HSAM, such as those in the hippocampus, prefrontal cortex, or any other localised area of the brain, when compared to individuals with typical memory functions [12,13].

Some differential diagnosis that can be addressed through psychometric testing include other psychiatric or cognitive disorders that may present with similar symptoms to those evident in subjects with HSAM. Memory tests help differentiate HSAM from bipolar disorder and OCD, thereby eliminating the impact of neurological or psychological disorders on the memory abilities of the tested individual [24,26].

Prognosis of HSAM

The condition HSAM is not lethal, and its outcome does not influence life expectancy. However, individuals with HSAM may experience some difficulties. Regarding mental health, although HSAM does not inherently drive mental health disorders, some people may find that their ability to recall traumatic or negative events leads to heightened anxiety or emotional stress [17]. Those with memory recall difficulties may feel overwhelmed by repeated memories of similar cases [20]. In terms of social and emotional functioning, retrieving both positive and negative personal experiences can be quite a lonely experience for some [3,9]. It can be emotionally challenging to dwell on either trivial or painful memories [16]. As for cognitive areas, cognitive impairment is not observed in HSAM, nor are new cognitive capabilities or superior cognitive function associated with it [9,26]. Surprisingly, explicit memories of general knowledge or academic facts among those with HSAM remain normative, meaning HSAM has been found to enhance autobiographical memory recall specificity [1,2,13].

Differential Diagnosis of HSAM

The differential diagnosis of HSAM involves comparing this condition with other memory disorders based on memory recall characteristics and other features. HSAM and savant syndrome share a common feature, as both refer to exceptional memories [14,15]. However, savant syndrome indicates that the individual is gifted in some way, such as in music, mathematics, or art, but also suffers from other learning disorders, particularly autism [14]. HSAM, on the other hand, is centered on autobiographical memories and is not associated with other cognitive or developmental disorders [13].

The condition HSAM shares similarities with OCD, as individuals with OCD may constantly refresh events in their minds [24]. However, this experience differs from OCD because, in OCD, recall results from compulsive behaviours and anxiety, while HSAM allows for the easy and natural recall of memories [24,26]. HSAM recall is more controlled and is not the result of rumination, as seen in other subjects [11].

Eidetic memory, or photographic memory, can be described as the capacity to reproduce or recall a visual or other sensory image for a brief period [21]. This differs from HSAM, which involves the extended retrieval of life experiences [21]. HSAM encompasses long, permanent memories that are subsequently vivid, while eidetic memories consist of short-term sensory impressions [3,12].

Treatment Availability for HSAM

Since no researchers or clinicians seem to have developed a successful treatment for HSAM, we suggest further research. Deep brain electrical stimulation is one potential therapeutic option that is being studied for Alzheimer's disease and may also be useful for HSAM [23,29]. However, if HSAM is classified as a subtype of OCD, there might be additional helpful therapies [22]. In particular, drugs categorised as serotonin reuptake inhibitors, which are a specific type of antidepressant, have demonstrated potential for use [30]. Furthermore, exposure and response prevention, a form of cognitive behavioural therapy, has shown benefits in certain OCD patients and may also be useful for HSAM [9,26]. We hereby, would like to call for more scientists and researchers to conduct further research on the treatment aspects of HSAM.

CONCLUSION(S)

In conclusion, HSAM can be described as a rather unique and interesting cognitive phenomenon that has remained an unresolved mystery, as long as, such individuals are capable of recalling detailed information associated with certain periods of their lives earlier than others. Nevertheless, with only 62 known cases, it offers valuable insights into the ways memory replay, brain function and their development operate. Therefore, the neural correlates, such as greater functional connectivity with the left temporoparietal junction and the hippocampal region, indicate that HSAM involves other physical structures and mechanisms.

However, the condition has emotional and psychological implications, including the inability to forget painful or even ordinary memories, which can cause stress or anxiety. Although the symptoms of HSAM are similar to those of autism and OCD, its functioning is different; therefore, it requires further study. To distinguish HSAM from other memory-related disorders, memory tests or fMRI/PET scans are employed. At present, there is no cure, but cognitive behavioural therapy is available. Further investigation should be conducted to uncover the facts behind this condition, as well as the specific type of neurological issue, in order to develop a specialised treatment that allows individuals affected by this condition to lead better lives.

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PARTICULARS OF CONTRIBUTORS:
1. Undergraduate Student, Jawaharlal Nehru Medical College, Datta Meghe Institute of Higher Education and Research, Wardha, Maharashtra, India.
2. Undergraduate Student, Jawaharlal Nehru Medical College, Datta Meghe Institute of Higher Education and Research, Wardha, Maharashtra, India.
3. Professor, Department of Microbiology, Jawaharlal Nehru Medical College, Datta Meghe Institute of Higher Education and Research, Wardha, Maharashtra, India.
4. Assistant Professor, Department of Psychiatry, Jawaharlal Nehru Medical College, Datta Meghe Institute of Higher Education and Research, Wardha, Maharashtra, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Rohit Wani,
Undergraduate Student, Jawaharlal Nehru Medical College, Datta Meghe Institute of Higher Education and Research, Wardha-442107, Maharashtra, India.
E-mail: rohitwani72@gmail.com

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